THE RATE OF GROWTH IN EPISTYLIS FLAVICANS.

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The writer recently had an opportunity to observe the rate of growth in one of our common stalked Protozoa, *Epistylis flavicans Ehr.*, and the changes in form of the animalcule which accompany this growth.

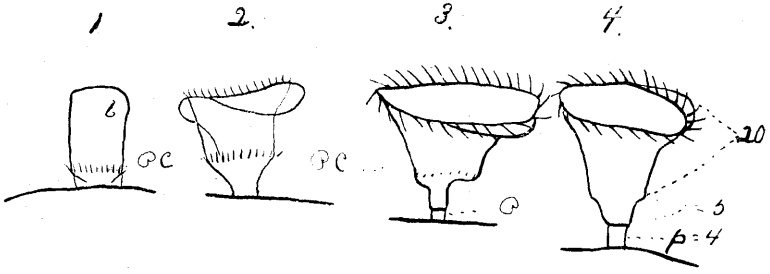
A good deal of interest attaches to the rate of growth of the pedicle in stalked forms on account of the fact that two species frequently otherwise similar may be differentiated by the length of pedicle. A form with branched pedicle, which in its adult condition may be easily differentiated by the pedicle, is with difficulty separated from other species if its pedicle is still simple as it is in the earlier stages of growth. Each form having a branched stalk passes through a stage in which its stalk is simple and it is then sometimes with difficulty separated from the forms with unbranched pedicles.

The frequency with which these immature forms are met with depends of course upon the time required for a detached zooid to acquire a pedicle characteristic of the adult form. If this is done uqickly, for instance, in a few hours, comparatively few immature forms would be encountered. If the period of growth is longer, for instance, several days or a week, one ought to find immature forms rather frequently. During the three summers spent in work on Protozoa at Sandusky no case of growth except the present instance was observed that could be measured. This may be due to the fact that work was commenced about the first of June each year which would be after the period of maximum growth among the Protozoa, this period coming earlier in the spring.

In the present case the attachment of the free swimming form was not observed. But in mounting a slide for observation a large colony of *Epistylis flavicans* was found many of whose zooids were detached and swimming about. Within a short time one was found attached and its rate of growth observed. It could have been attached only a short time for it still had the typical cylindrical shape characteristic of free swimming forms (Fig. 1). The posterior circle of cilia was vibrating rapidly and there was only a faint movement of the cilia visible in the region of the gullet.

In three minutes it had assumed the form of Fig. 2. The posterior cilia were vibrating a little less rapidly. There was a cone shaped extension at the posterior end of the body equalling one-third of the total body length and extending proximally from the posterior circlet of cilia. The body had begun to assume the normal shape the adoral cilia were vibrating and the

total width of the peristome was about two-thirds of the adult form. In two minutes more it had assumed the form shown in Fig. 3, the posterior end had narrowed considerably and while the constriction extending from the posterior ciliary wreath was still one-third the total length of the body its attached end had assumed the appearance of the adult pedicle. The lengthening of this pedicle had every appearance of growth and not of metamorphosis of body into pedicle. The body while producing the pedicle was actually larger than before, and although the form was feeding rapidly it is hardly conceivable that assimilation and growth could take place at the rate at which the pedicle appeared.



DESCRIPTION OF PLATE.

Fig. 1. Four stages in the growth of the pedicle of *Ephistylis flavicaus* Ehr. p. c.—posterior circlet of cilia. p.—pedicle appearing first in Fig. 3.

At the end of five minutes more (Fig. 4) the body of the animalcule was nearly normal in every respect except that the slight elevation on which the posterior circlet of cilia had been situated could still be observed although the cilia had been retracted. The pedicle at this time was one-sixth the length of the body and the animalcule was feeding actively. From this point on only the relative rate of growth in the pedicle will be given as no opportunity offered to note any other histological changes than those pertaining to the lenghtening of the pedicle.

At the end of five minutes more or a total of fifteen minutes in all the pedicle was equal to one-fourth the length of the body; in twenty minutes one-third; at twenty-five minutes one-half; at thirty minutes, thirteen-twentieths; at thirty-five minutes, four-fifths, and at the end of forty minutes equaled the body in length.

It was not observed again for a period of forty-five minutes during which time the pedicle had attained a length equal to three times that of the body. This is somewhat under the normal, the unbranched pedicle usually being four to five times that of the body. So that a period of one hour and a half was sufficient to produce a pedicle nearly equal to the unbranched por-

tion of the adult colony stalk. Of course to make this observation complete the rate of division in the zooid should be observed and also the rate of production of the branched portion of the pedicle.

At the end of one hour and thirty-five minutes the posterior circlet of cilia began to appear and in an hour and fifty-five minutes the animalcule became detached and swam away.

The presence of the cover glass, the lack of oxygen and food all three probably prevented the completion of the growth and probably retarded the later stages of it but otherwise it seems normal and furnishes some idea of the rate at which the single stalked and branched stalked forms of Protozoa produce their pedicles.

The rapid rate of growth also accounts for the rarity with which one finds immature forms especially those with compound pedicles and yet they do occur frequently enough to render the difficulty of identifying these forms very great.

These observations were made in August and the rate of growth may be quite different from that occurring earlier in the summer during the period of greatest activity among the Protozoa.